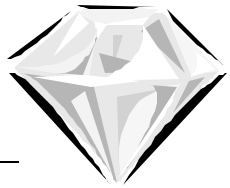
Name: _____

The Structure of Crystals



Beautiful solids with regular, three-dimensional patterns have been prized for thousands of years.
Choose one crystal to observe. Describe it in great detail, and then draw it.

_____
_____
_____
_____

Crystal Structure

A crystal is a solid in which the molecules are arranged in a three-dimensional repeating pattern. Most solids are crystalline. Salt, sugar, ice, and diamonds are common examples of crystals. Crystals come in a variety of geometric shapes. What are some of the shapes you saw when you examined the crystal samples? When you looked at the salt crystals you should have seen little cubes. If you were to examine snowflakes under a microscope you would see crystals in the shape of hexagons. Sulfur crystals are in the shape of octagons. A crystal's shape depends on the arrangement of the particles within it.

There are seven crystal systems (or geometric shapes) into which all known crystals are classified. The seven crystal systems are: cubic, tetragonal, hexagonal, rhombohedral, orthorhombic, monoclinic, and triclinic. You can view a diagram of each of the systems at this website: http://cst-www.nrl.navy.mil/lattice/spcgrp/spcgrp.html. Click on the name of system to view a graphic and information.

Some crystals are very large and can be seen with the naked eye. Some can be seen only with special microscopes.

The shape and properties of a crystal depend on the atoms that make up the crystal and how strongly the molecules are bonded together. In fact, there may even be different crystals of the same substance. For example, diamond and graphite are two common forms of solid carbon. Even though both crystals are made of carbon, their atoms are arranged differently. In diamond, each carbon atom is strongly bonded to four others in a cubic lattice. In graphite, the carbon atoms are packed more loosely in hexagonal layers with weak bonds between them. Graphite is a dull, slippery solid with a low melting point. In contrast, diamonds are sparkly, have a high melting point, and are very strong. Even though both crystals are made of carbon, they are very different from each other.

Some crystals form naturally in the earth, and have taken thousands or millions of years to grow. Some form as hot solutions of chemicals or molten rock (lava) cool deep within the earth.

Naturally formed crystals are called minerals. Gemstones like emeralds, diamonds, sapphires and rubies are all crystalline solids that form naturally under the right conditions. They are cut to various shapes for use in jewelry. Crystals can also be produced synthetically using special equipment. Synthetic (man-made) crystals can even be made in your kitchen.

Explore Crystal Formation

Procedure:

1. Wearing eye protection, mix 10 ml ammonia, 10 ml bluing, 10 ml water, and 10 g salt in a small beaker.

2. Put a crushed charcoal briquette on an aluminum plate.

3. Dropper your solution on the briquette.

4. Drop some food coloring on the briquette, in any pattern you prefer.

5. Observe your crystal garden for seven days.

Results:

Carefully observe your crystal garden with a hand lens. Draw several crystals here:

6. Describe how crystals form, in terms of molecules and forces: _____

_____

_____

An Exploration At Home

Candy Crystals

In a large mixing bowl place six cups of cold water. Slowly add in the sugar, stirring until the sugar is completely dissolved, and until no more sugar can be incorporated. Pour the sugar water in a clean two-quart jar. Take a bamboo skewer, clean it, wet it and then roll it in sugar. Place the skewers in the jar, and cover with a clean cloth to keep out dust. The jar should be placed in an area where it will not be disturbed. In a few days crystals will start growing on the skewers. It will take about two weeks for the crystals to grow to their maximum size (for all the water to evaporate). You can add food coloring or flavoring to the solution if you prefer.

1. Why do you think you seeded your skewer? _____

2. Where do you think the crystals would form if you did not place a skewer in the jar? _____

3. What evidence do you have that sugar is still in the water? _____